Mosaic evolution

JEREMY M. DeSILVA
Dartmouth College, USA

Different parts of a species' biology evolve at different rates, resulting in organisms possessing a combination of primitive and derived characteristics. This differential pace of evolutionary change is commonly referred to as *mosaic evolution*. An early exposition of this idea was put forward by W. K. Gregory (see GREGORY, WILLIAM KING) (1910), who noted that organisms are a combination of what he called caenotelic (derived) and paleotelic (primitive) features. Robert Broom (see BROOM, ROBERT) (1924) used the metaphor of a palimpsest—the ancient practice of repeatedly writing and erasing text on the same piece of parchment—to refer to this phenomenon. The concept was further elaborated and popularized by G. G. Simpson (see SIMPSON, GEORGE GAYLORD) (1944) and Gregory (1947), and given the label "mosaic evolution" by Gavin de Beer (1954), who used it to describe the combination of primitive dinosaur-like and derived bird-like features in *Archaeopteryx*.

In the context of human evolution, this concept has most often been applied to the disjunction between the acquisition of human-like brain size and human-like bipedalism (see BRAIN EVOLUTION (PRIMATE) and BIPEDALISM). D. J. Morton (see MORTON, DUDLEY J.) (1926) was perhaps the first to remark on this disjunction, noting that the Trinil *Homo erectus* material from Java combined a derived, human-like femur with a more primitive, small-brained skullcap. Although it is now thought that the Trinil femur is actually from a modern *Homo sapiens* and is a relatively recent intrusion into the Early Pleistocene sediments that yielded the *H. erectus* skullcap (Ruff et al. 2015), later discoveries of early *Homo* have confirmed Morton's basic insight. The proposition that bipedalism long preceded brain enlargement in human evolution was further confirmed by the discovery and description of the small-brained but bipedal *Australopithecus* fossils from South Africa (Broom and Robinson 1947; Le Gros Clark 1947; Washburn and Patterson 1951). In 1959, Wilfrid Le Gros Clark (see LE GROS CLARK, WILFRID EDWARD) first applied the term *mosaic evolution* to describe this disjunction between brain and locomotor evolution in the australopiths (Le Gros Clark 1959). It is now commonly accepted that two of the most distinctive human characteristics—bipedalism and large brains—evolved at different rates and at different times in our lineage (McHenry 1975) and that the disconnect between locomotion and encephalization extends into the Pliocene (White 1980). Ever since Ernst Mayr (see MAYR, ERNST) cited the evolution of the Hominidae (see HOMINIDAE: CONCEPTUAL HISTORY) as a "classic example" (Mayr 1963, 344) of evolutionary mosaicism, the term has been widely employed in the scientific literature on human evolution.

"Mosaic evolution" is also commonly used to refer to the sequential acquisition of evolutionary novelties within a single region or structure of the body—for example, in the hominin brain, canines, thorax, hand, pelvis, and foot. The term has additionally been used to describe the patchwork evolution of nonmorphological features such as human speech, traits of human life history, and even the human genome. The ubiquity of mosaic patterns in human evolution, even within functional complexes, casts serious doubt on whole-body reconstructions of fossil hominins from isolated elements.

SEE ALSO: Australopithecine/australopith; Brain growth; Evolution; Morton, Dudley J.; Saltation and stasis; Southeast Asian fossil record

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